AGENCE DE L'OCDE POUR L'ÉNERGIE NUCLÉAIRE

OECD NUCLEAR ENERGY AGENCY

Nuclear technology, the way forward

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Mr. Chairman, dear colleagues, ladies and gentlemen,

It is my pleasure to participate in this opening session of ICAPP 2005, a major international event for nuclear energy that my organisation, the OECD Nuclear Energy Agency, is honoured to co-sponsor.

The topical sessions of the Conference feature papers covering technical and economic aspects of advanced reactors recently commissioned, currently under construction or planned to be ordered soon. As a backdrop to the topical sessions, I would like to share with you some views, mainly drawn from studies carried out by my Agency, on the continued progress of nuclear technology, including the improvement of its technical and economic performance, and on the future prospects for its development.

While touching upon a broad range of issues, I will try to highlight the challenges and opportunities facing nuclear energy today. In this connection, it is very important to note upfront that the present generation of nuclear power plants, benefiting from the feedback of experience over several decades, succeeds already in meeting most of the requirements of modern society. Nuclear energy contributes to the safe, environmentally friendly and economic supply of electricity in more than thirty countries around the world. Nuclear power plants provide nearly a quarter of the electricity consumed in OECD countries and, at the world level, this share remains significant with some 16%.

However, technology progress is a continuing process and a new generation of nuclear systems will need to be developed eventually to ensure the adaptation of nuclear energy to future economic and social requirements. In this connection, I'll conclude my talk by touching upon R&D programmes in place to support the development of nuclear energy systems of the 4th generation.

Policy making landscape

Before reviewing technology progress, let me reflect rapidly on significant changes in the policy-making landscape in the energy sector and in particular for nuclear energy. In many countries, while economic competitiveness in deregulated markets remains a cornerstone, sustainable development goals, including social and environmental aspects, are broadly recognised. It means that security of energy supply and reduction of atmospheric pollution, for example, are integrated in a multi-criteria analysis that supports decisions taken by governments and the industry on technology options to be included in the future energy mix.

In this context, a large number of policy makers consider today that nuclear energy has a role to play in sustainable energy supply mixes for the 21st century. Although OECD countries remain divided in their policy on nuclear energy use, the benefits of nuclear energy are recognised more readily at the highest decision level than it was the case in the late 1990s. Several events, at the national and international levels, illustrate this renewed interest of policy makers for nuclear energy.

In September 2004, the World Energy Congress – held in Sydney, Australia – included many presentations and discussions about the relevance of nuclear energy to address security of energy supply and global climate change concerns. More recently, an International Conference on Nuclear Power for the 21st Century, was organised by the International Atomic Energy Agency (IAEA), hosted by the French Government and co-sponsored by the OECD and the NEA. The Conference, held in Paris on 21 and 22 March 2005, was attended by Ministers, high-ranking officials and experts from 74 States and 10 international organisations. A wide range of views were expressed at the Conference but there was a broad agreement on the unique opportunities offered by nuclear technologies to meet increasing energy demand, alleviate the risk of global climate change and ensure security of supply, in particular in countries not having access to large fossil fuel resources.

The evolution of the policy-making context is very important and likely will facilitate the implementation of new nuclear power projects. Nevertheless, the performance of nuclear reactors and fuel cycle facilities in operation remains essential for the future of nuclear energy systems. The achievements of nuclear energy systems in operation are paving the way for a broader use of the nuclear option and the development of advanced systems for the future.

Technical improvements

Dramatic technology progress was accomplished in a few decades of nuclear energy system development, from connection to the grid of the first reactors generating electricity in the 1960s to a fleet of more than 400 units in operation in more than 30 countries today. The total operating experience worldwide has reached around 12 000 reactor-years of which nearly 90% was acquired in OECD countries.

Technical progress in the field of nuclear energy, accomplished through scientific research and feedback from experience, covers a wide range of achievements including enhanced plant reliability, increased fuel performance and burn-up, reduction of radioactive waste volumes and toxicity, capacity up-rating and life extension.

Regarding reliability, for example, the latest statistics from the industry show that since 1997 the number of unplanned automatic scrams per 7000 hours critical has dropped form nearly 2 in 1990 to 0.7 in 2002 and 2003 for the more than 420 plants included in the surveys. Also, the average availability factor of plants in operation worldwide increased from less than 75% in the early 90s to more than 80% in the first years of the 21st century. In several OECD countries, including the Republic of Korea, this factor has reached or even exceeded 90% in the first years of the 21st century.

The technical improvements also resulted in the capability of operators to extend operation of nuclear units beyond their initially expected lifetime. Many units have been licensed for a total lifetime reaching 60 years and the trend to lifetime extension is observed in most countries where nuclear plants are operated. Often, plant life management measures aiming at lifetime extension include capacity up-rating. In most cases, these two actions combined, life extension and up-rating, are by far the cheapest option for electricity generation.

Improved thermodynamic efficiency contributes to better technical and economic performance. Evolutionary advanced reactors show progress already in this regard and, obviously, high temperature reactors will be a major step forward.

In the fuel cycle domain, technical progress led to enhanced reliability of fuel rods and assemblies as well as possibility to reach higher burn-up. Higher burn-up is a means to enhance the efficiency of natural resource utilisation and offers additional flexibility in the management of plant reloading schedules.

The excellent safety records of nuclear power plants and fuel cycle facilities result from technology progress but also from the implementation of a rigorous safety culture worldwide. In this connection, it should be noted that international organisations such as the Nuclear Energy Agency of OECD and the International Atomic Energy Agency (IAEA) are providing facilitating frameworks.

Continued technology progress and good management practices have permitted to keep the impacts of nuclear energy facilities on human health and the environment extremely low. For example, the outcomes of the Information System on Occupational Exposure (ISOE) launched by the NEA in 1992 and co-sponsored by the IAEA show that improved plant designs and better control of water chemistry, as well as enhanced operational procedures, have contributed to a steady decrease of occupational exposures in nuclear power plants and fuel cycle facilities since the early 1990s.

Economic performance

The competitiveness of existing nuclear power plants on deregulated electricity markets has been demonstrated in many countries and is no longer challenged. With their low and stable marginal costs and high reliability, nuclear units in operation often are the least cost option for base load generation in competitive markets. Furthermore, market competition has led nuclear power plant operators to enhance efficiency and reduce running costs. This is demonstrated by the trend in the United States, for example, where marginal cost decreases reaching 50% in average over the last two decades are reported by utilities operating nuclear power plants.

Recognising that nuclear power plants are capital intensive, designers have endeavoured to reduce their capital costs. The advanced evolutionary reactors which are the focus of this conference integrate in their concepts many features aiming at lowering construction costs and shortening construction periods, which help reducing interest during construction and lowering financial risks. Streamlined designs, passive safety features, modularity and increased reliance on building large equipment in factories are among the means used by plant manufacturers to reduce capital costs.

The competitiveness of new nuclear units is a more recent trend which is illustrated by the results of the study on projected costs of generating electricity carried out by the Nuclear Energy Agency and the International Energy Agency, and published by the OECD in 2005. A paper reporting the main findings from this study will be presented later this afternoon; therefore, I will not elaborate on the framework of this study. The results, however, highlight that, in countries considering the nuclear energy option for new plants to be commissioned by 2010-2015, nuclear electricity is the cheapest nearly everywhere at 5% discount rate and remains competitive in several countries at 10% discount rate.

Furthermore, in the context of implementing sustainable development policies, governments are considering measures to internalise external costs. Costs borne by society rather than by consumers of goods and services not only prevent market mechanisms to be efficient but also provide wrong price signals to users and thereby lead to behaviour adverse to economic, social and environmental optimum.

In the case of nuclear electricity, all costs associated with decommissioning of facilities and waste management and disposal are included in the generation costs supported by the plant operator and passed on consumers. Therefore, the external costs of nuclear electricity are very small and their eventual internalisation will not affect the competitiveness of nuclear energy. On the other hand, the costs of generating electricity from fossil-fuelled plants will inevitably increase when the cost of carbon emissions, for example, will be internalised.

The external cost associated with insecurity of supply is more difficult to evaluate precisely but concerns about security of energy and electricity supply are high on the agenda of policy makers especially in OECD countries. According to the last World Energy Outlook of the IEA, in the absence of policy measures to enhance their domestic energy production the OECD countries will be importing some 85% of their oil supply and more than 40% of their gas consumption by 2030. Nuclear energy may play a key role in alleviating this dependency.

Social and environmental aspects

Social perception of nuclear risks and their acceptance by the public are a key issue for the future development of nuclear energy. It is interesting to note in this regard the evolution of public opinion following recognition of the needs for more energy. Clearly, society assesses risks and benefits in perspective. The threat of global climate change, the concerns about security of energy supply and the increasing demand for energy to ensure social development are driving factors in social perception of risks associated with alternative energy supply options.

Nevertheless, addressing social concerns about nuclear energy remains an important goal for the industry stakeholders and governmental bodies in charge of nuclear and energy policy issues. I will take one example to illustrate the social challenges and obstacles to be overcome in order to facilitate future development of nuclear energy: high level waste disposal.

Technically, high level waste management and disposal is barely an issue. Experts agree that the safe disposal of all types of radioactive waste is feasible in the respect of health and environmental protection norms and regulation. Furthermore, the volumes of high level radioactive waste are small enough to be isolated from the biosphere at acceptable costs. However, the implementation of repositories is a main milestone requiring social understanding and support. Several OECD countries are making progress in this field, notably Finland and the United States, but continued proactive government policies in all countries aiming at the commissioning of HLW repositories are a prerequisite for the renaissance of nuclear energy programmes worldwide.

Before leaving social aspects of nuclear energy, I would like to underline one of the key benefits of this technology for society which is sometimes underestimated by policy makers. Social welfare depends not only on GDP per capita but also on access to attractive jobs. Nuclear science and technology add to intellectual capital of our societies. The nuclear energy sector requires highly qualified manpower for plant operation, regulatory bodies and R&D institutes. Clearly, these beneficial social impacts are of high importance and maintaining scientific nuclear knowledge as well technical know-how constitutes an interesting social dimension of future nuclear power programmes.

R&D for the future

The nuclear energy systems in operation or under construction today have been designed taking advantage of scientific research and technical development undertaken decades ago. The nuclear power plants and fuel cycle facilities to be commissioned until the end of 21st century and beyond will be based on the outcomes from the R&D programmes ongoing today.

Conceiving and designing innovative nuclear energy systems meeting social, economic and environmental requirements of the coming decades will require sustained R&D programmes covering a broad range of topics from basic science to technological applications. While the needed efforts present a challenge to each country and industrial stakeholder, joint undertakings offer opportunities to share knowledge, past experience and expenses and enhance the global capabilities to achieve common goals.

International cooperation is a very powerful means for promoting scientific and technical progress with the most efficient use of national resources. Multinational programmes take advantage of multicultural team synergies and may rely on a broad range of infrastructures available in all participating countries.

Generation IV International Forum (GIF) illustrates the strength of international cooperation in focusing joint efforts towards shared goals and common objectives. Ten countries and one international organisation joined their efforts to select promising nuclear energy systems and implement the R&D framework and programmes necessary to demonstrate the viability of those systems. At the request of GIF members, the Nuclear Energy Agency has accepted to be responsible for its Technical Secretariat. Other international or multilateral endeavours are ongoing aiming at improving the performance of nuclear energy systems and eventually strengthening the role of nuclear energy in sustainable supply mixes for the future.

Concluding remarks

In this key note speech, I have outlined only a few issues, trying to highlight the main challenges facing the nuclear energy sector. This International Congress will provide many opportunities for exchange of information on cutting edge technological developments. In depth discussions between senior experts from many countries surely will foster cooperation in innovative R&D fields.

I am sure that the findings and conclusions from this meeting will be of high interest and will support continued progress in the field of peaceful applications of nuclear energy. My Agency, which is co-sponsoring this event, will endeavour to integrate the outcomes in its future activities in support of member country national programmes.